You could never find this in a SHOP!

Using measurement skills to make pencil cases

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provide an insight into a Grade 5 classroom where students were involved in a real-world project which enhanced their measurement skills.

Measurement is a mathematics skill students encounter often in their daily lives (Reys, Lindquist, Lambdin, Smith, and Suydam, 2004). The act of measuring involves the use of concrete, hands-on materials that students find engaging and appealing. According to Martinie (2004), the best way to teach measurement "is to find or create situations in which students need to measure and let them experience this process" (p. 431). Preston and Thompson (2004) concur that "the most fundamental aspect of measurement is the act of measuring" (p. 438). The measurement lesson we presented to a group of grade 5 students is a good example of how measurement can provide a hands-on experience that is off the traditional "beaten path" of the typical daily maths lesson and enlist the students in enjoyable, real world work.

Solving a problem

From the beginning of the school year, Patty's grade 5 students argued regularly over the baskets of coloured pencils used for art activities. The pencils were loose and in no particular order, which made it difficult for children to find the colours they wanted. Some pencils were quite small, and these were the least desirable for the children. This problem took away valuable instructional time.

So when Mary, a professor at a local university, suggested helping the students with a measurement project involving the creation of pencil cases through sewing, Patty saw this as a valuable teaching opportunity. The pencil cases would make it possible for each student to have their own set of pencils. Not only would Patty's Grade 5 students have a chance to solve an ongoing problem, they would also have an opportunity to practice their linear measurement skills in a hands-on, practical manner.

Teaching measurement

Although very little research, if any, exists on the use of sewing projects to teach measurement, some studies have shown connection between intellectual development and handiwork, such as knitting and sewing. According to Schwartz (1999), "Recent neurological research tends to confirm that mobility and dexterity in the fine motor muscles, especially in the hand, may stimulate cellular development in the brain and so strengthen the physical foundation of thinking" (p. 248). We have found that ongoing integration of hands-on work into the mathematics curriculum tends to sustain children's attention and interests.

Even though Patty's grade 5 students knew the basics of linear measurement, it was believed that the project could be used to assess students' understanding of linear measurement. Furthermore, it was an opportunity to engage students in an investigative and problem solving aesthetic experience. In addition, the pencil case project would satisfy what Reys et al. (2004, pp. 391–392) believed were reasons for including measurement in the mathematics curriculum:

- It provides many applications to everyday life.
- It can be used to help learn other mathematics.
- It can be related to other areas of the school curriculum.
- It involves students in active learning.
- It can be approached through problem solving.

The project

Although students did not require previous sewing experience, they were taught how to thread a needle, tie a knot, and sew two basic stitches — the running stitch and the blanket stitch. Costs associated with the project were minimal, and largely dependent on the type of fabric used. The materials required for a class of 25 students were as follows:

- 60 pieces of sturdy fabric (e.g., felt or denim) of various colours, measuring 31.5 × 23 cm;

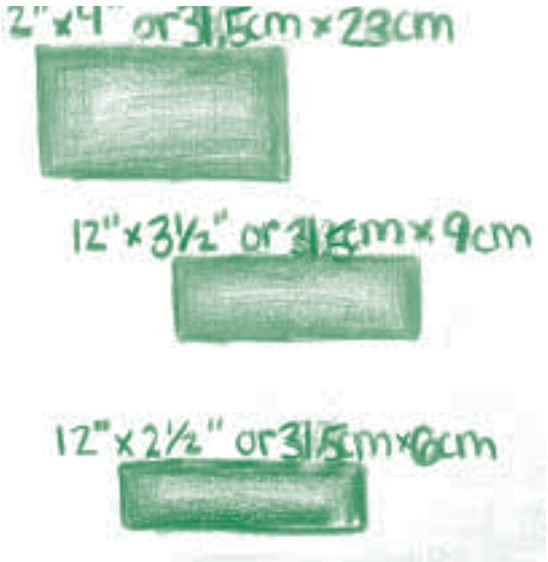

Figure 1

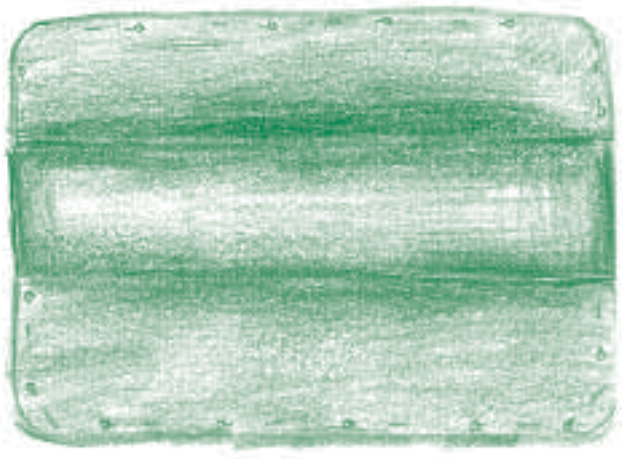

Figure 2

- 250 pins;
- 25–30 embroidery needles;
- 30 packages of sewing thread, various colours;
- 7.5–9 metres of thin ribbon;
- 25 rulers;
- 25 pieces of tailor's chalk;
- 25 pairs of scissors.

As shown in Figure 1 the measurements for the three pieces of felt needed for the cases were:

1. 31.5 cm × 23 cm
2. 31.5 cm × 9 cm
3. 31.5 cm × 6 cm

Measuring the first piece proved more challenging than originally expected. Some students did not know where to lay their ruler to begin measuring and needed assistance. Others did not know how to measure 0.5 cm. Fortunately, the students who initially struggled when measuring the first piece needed little or no help by the time they measured and cut the second and third pieces.

After everyone had measured, marked with chalk, and cut their material, the next step was to pin everything together (see Figure 2).

When the pinning was successfully completed, and students rounded the corners with their scissors, they were ready to begin sewing. Students were instructed to stitch all around the perimeter of the pencil case and asked to estimate the number of stitches made per centimetre. NCTM's (2000) Measurement Standard expectations for students in grades 3–5 recommends that students learn to select and use benchmarks to estimate measurements. Using mathematical language in context helps children remember and sustain the terminology. The next step involved sewing the individual slots for the pencils, using the simple running stitch. However, before this stitching began, additional measuring was required. The slots for the pencils measured 2.5 cm. In order for the stitches to be straight, it was important to measure the 2.5 cm increments on the bottom as well as on the top of this piece of material, then connect the marks with a chalk line (see Figure 3). Most students successfully completed this measurement activity, although a few children experienced difficulty with holding the ruler and connecting the marks.

Once the 2.5 cm slots were measured, marked, and connected, students could begin sewing. There was one tricky part to this portion of the project. After stitching the first line with the running stitch, the stitch going across to the second line was to be only on the top portion of the fabric. In other words, it could not go through both pieces because the pencil would not be able to be inserted. This made perfect sense to the students, and no one made that mistake.

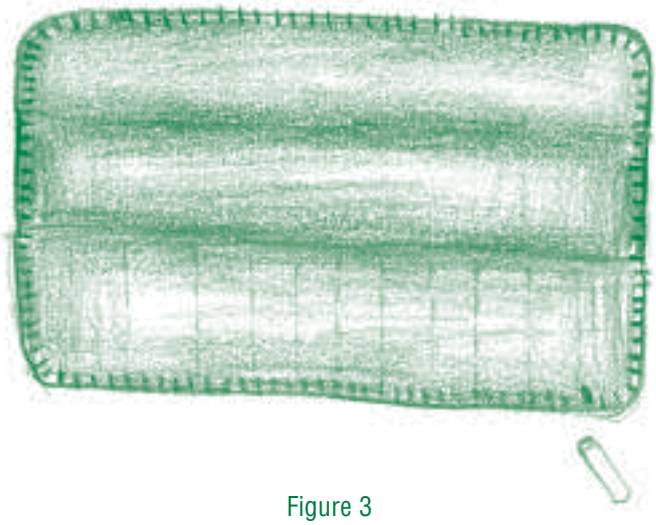

Figure 3

Figure 4

Two more measurement activities were required in order to finish the pencil cases. Students first needed to measure and cut a 3 cm square of material. They then had to measure and cut a 61 cm piece of ribbon. The 3 cm square piece of material and the ribbon were necessary to close the pencil case. The square of material was sewn on the back middle portion of the case on three sides with the blanket stitch. Before finishing the fourth side, the ribbon was doubled, inserted and sewn in (see Figure 4).

Insights from the children

The students were pleased with their finished products and faces lit up with smiles of accomplishment and satisfaction. We decided to ask students questions about the project in order to gain insight as to how something like this helped them with measurement.

Students' answers ranged from feeling quite confident in their ability to measure to admissions regarding their lack of experience with rulers. A few students commented that measuring was hard because they had not had a lot of experience with it and there was confusion using the ruler. Another child said that measuring was difficult because he did not know how to find half a centimetre. Two students used problem solving when they realised their piece of material was 30 cm wide rather than 31.5 cm. "When I found out my piece of material wasn't exact, I thought all my other measurements would be off, but I trimmed them to the size of my original piece and it worked out."

Figure 5

Students also provided interesting insights regarding other things they learned as a result of the project. One student commented that she was able to work with measuring the perimeter and that was a good hands-on experience for her. The following students' comments reinforced our hope that this project encouraged mathematical thinking:

- "You have to think about it in mathematical terms or else you may mess up a whole bunch."
- "Some people's minds can't think with numbers; they have to show what they know in a practical way."

Many comments from students actually fell into the realm of the affective learning environment. According to The Australian Association of Mathematics Teachers' *Standards for Excellence in Teaching Mathematics in Australian Schools* (2006, Domain 3), it is critical for teachers to address the psychological, emotional, and physical needs of students. Many students shared with us that they found out maths could be fun. One student mentioned that the pencil cases were a practical project as well as a learning experience. Another student mentioned that projects are fun and you end up with a "story and a product." Given that one of the benefits of teaching measurement is its practical nature, we were pleased with the fact that many students realised the connection between mathematics and practical types of projects.

Finally, students shared with us some personal thoughts. One child commented that this project allowed her to put heart and emotion into it, whereas if she bought a pencil case from a shop, it would not feel the same. Schwartz (1999) concurs: "In an age when children are too often encouraged to

become passive consumers … engaging in … hand[i]work can be a powerful way of bringing meaning into a child's life" (p. 256). Students also told us that it felt really good to finish a project and to accomplish something that was challenging. Others loved the quiet and relaxing nature of the project. In winding up our discussion, one student shared that her pencil case was something she would "treasure and use forever."

Reflections

After the pencil case activity was over, we reflected on both the positive and negative aspects of the lesson. As teachers, we were both surprised about how confusing measuring could be, even for grade 5 students. We came up with a few suggestions for improving the process we used with the students:

- Have all the steps to the measuring/sewing project written down on a large sheet of paper (preferably with illustrations). Include step by step instructions and highlight all measurements.
- Review where to begin measuring with the ruler, and how to read all the ruler's lines.
- Review horizontal and vertical, using descriptions such as "like the horizon" and "up and down".
- For the sewing part of the lesson, review threading a needle, how much thread to use, single or double threading, and model/go over all the required stitches.
- Group the students more effectively in teams. Integrate strong/weak children in both math and sewing skills. Intersperse good listeners with ones who need more help focusing, and combine fast and slow workers, so the speedier finishers could be available to help those struggling and straggling.

Making the pencil cases appeared to be a successful project for Patty's class. All students were involved and the lessons themselves were a model for differentiating instruction, because students could work at their own pace and receive help when needed from the adults or from other students who worked more quickly. The initial problem of arguing over coloured pencils was solved, as the children each now had their own complete set of pencils.

According to Wilson and Osborne (1988, in Reys et al., 2004), "Because most research does not clearly stipulate just how teachers should plan for instructional lessons on the subject of measurement, students should be given frequent opportunities to use measurement in their school experience, most preferably through real-life work projects that involve doing and experimenting rather than by passively observing" (p. 109). When elementary age children are presented with measurement activities as something they can engage in rather than simply watch, the experience for them provides involvement and enjoyment, along with the practice of standard measuring skills necessary in everyday life.

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